

National Aeronautics and
Space Administration



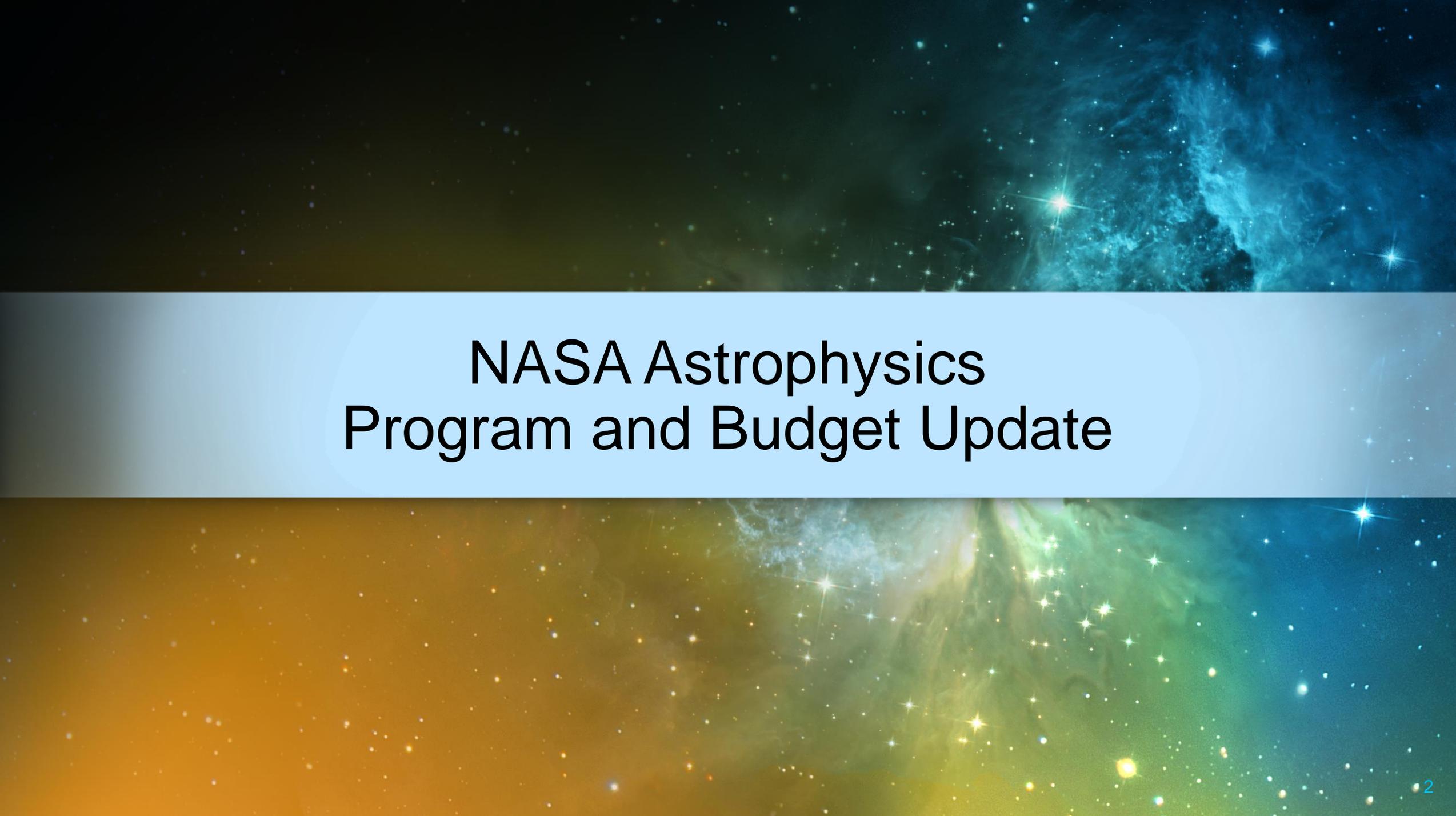
EXPLORE SCIENCE

NASA Astrophysics Update @ PCOS Town Hall

AAS HEAD Meeting | Monterey, CA | March 18, 2019

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Program Scientists, NASA Headquarters



NASA Astrophysics Program and Budget Update

Astrophysics Program Offices

After Restructuring

Astrophysics Division

Flight Programs

Astrophysics
Strategic Missions
@ HQ

Astrophysics
Explorers
@ GSFC

WFIRST
Webb*
SOFIA**

TESS IXPE
GUSTO XRISM
Euclid

Supporting Research and Technology Programs

PCOS/COR
@ GSFC

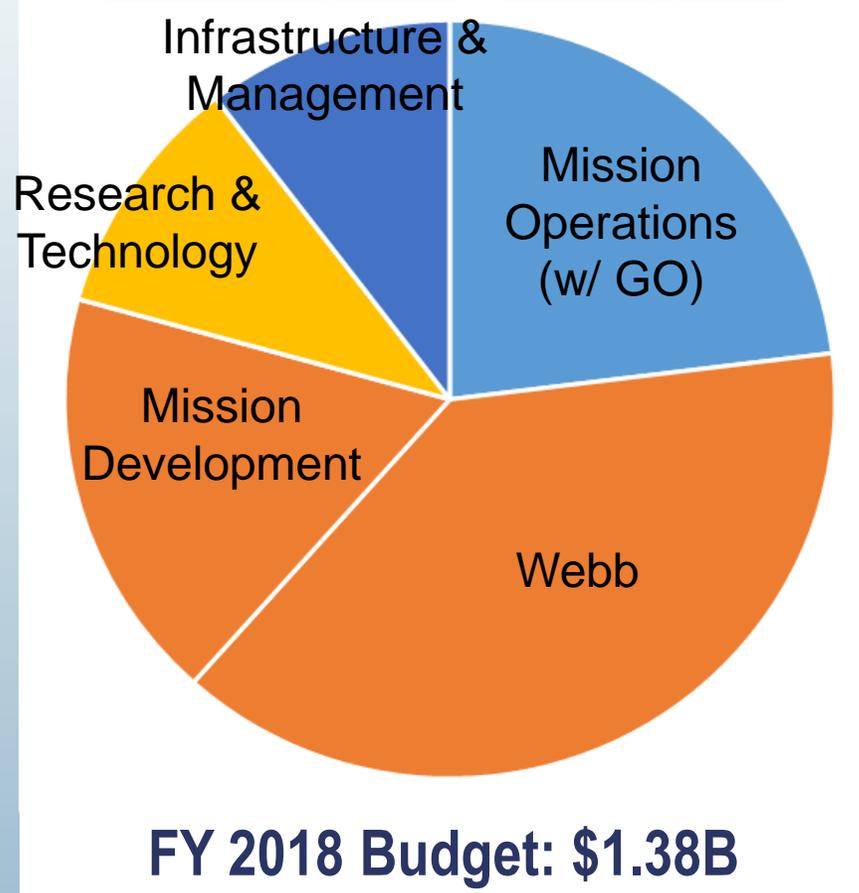
EXEP
@ JPL

Research
@ HQ

* after commissioning (CY2021)

** after reviews complete (CY2019)

NASA's Astrophysics Program



Strategic Missions

- Flagships and Probes led by NASA
- Contributions to partner-led missions

PI-led (competed) Missions

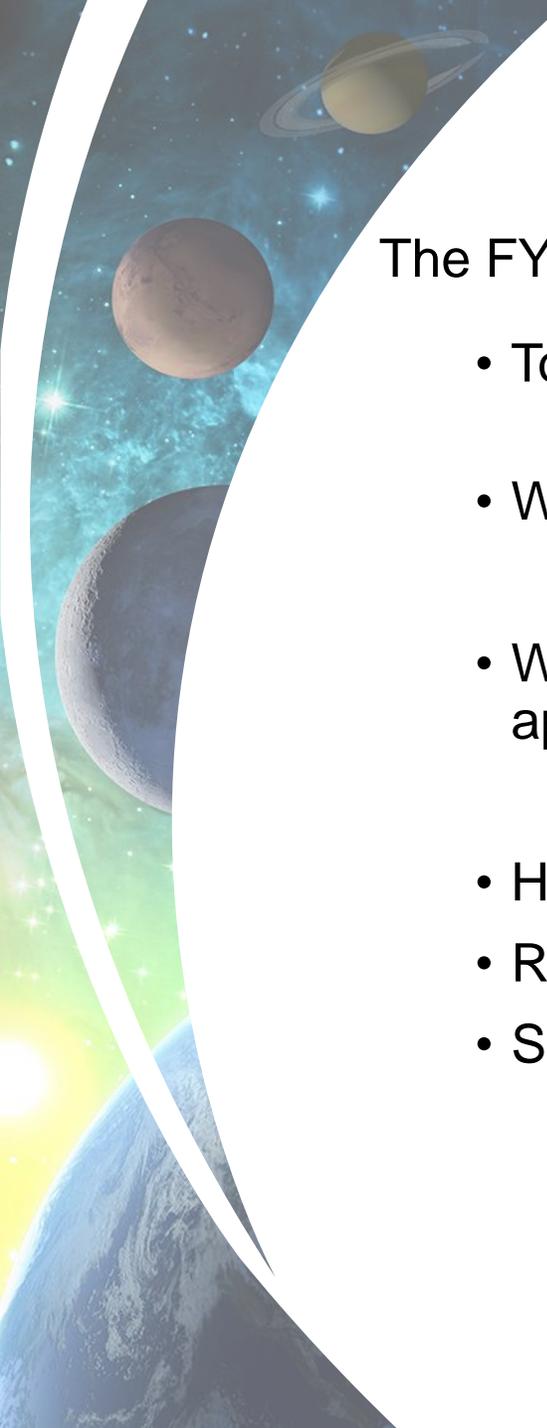
- Explorers missions (small and medium)
- Contributions to partner-led missions

Supporting Research and Technology

- Research and Analysis
- Technology development
- Suborbital payloads (balloons, sounding rockets)
- CubeSats and ISS-attached investigations

Infrastructure and Management

- Data archives
- Balloon Program
- Mission studies



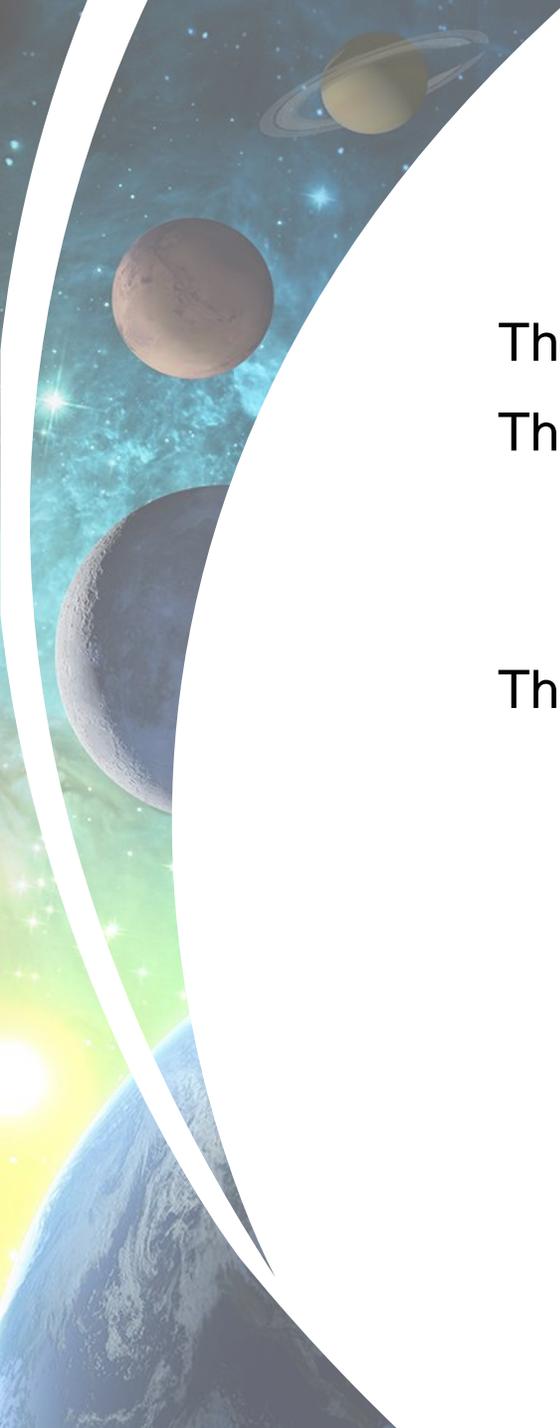
Astrophysics Budget Overview

The FY19 appropriation provides an increased level of funding for NASA Astrophysics:

- Total appropriated funding for FY19 (Astrophysics including Webb) is **~\$1.496B, an increase of \$112M (8%) from FY18 appropriation**
- Webb funded as requested at \$305M, request submitted before 2018 replan
 - Webb is reauthorized at 2018 replan level of \$8.8B for development
- WFIRST funded at \$312M, proposed termination not supported by Congressional appropriation
 - Appropriated amount is \$60M less than FY19 budget planned at KDP-B
- Hubble and SOFIA received appropriations above requested levels
- R&A and **Science Activation** specified at requested levels
- Spending on starshade technology and life detection technology is required
 - Spending on **technosignatures** is not required; nonetheless, Exoplanet Research Program will be clarified to make clear that technosignature research proposals are permitted

Astrophysics Budget – FY19 Appropriations

(\$M)	Administration Request	Final Appropriation	Comments
Astrophysics (w/ Webb)	1,185.4	1,496.2	
Webb	304.6	304.6	Reauthorize @ \$8.8B
Hubble	78.3	98.3	
SOFIA	74.6	85.2	Not in Senior Review
WFIRST	0.0	312.2	\$3.2B cost cap, launch in 2025
R&A	83.4	83.4	
Science Activation	44.6	45.0	
Technosignatures			Not directed, allowed in XRP
Search for Life Technology	>10.0	10.0	
Starshade Technology	7.3	10.0	
Rest of Astrophysics	592.6	557.5	Reduce \$35.1M (-6%)



Astrophysics Budget Overview

FY20 President's Budget Request

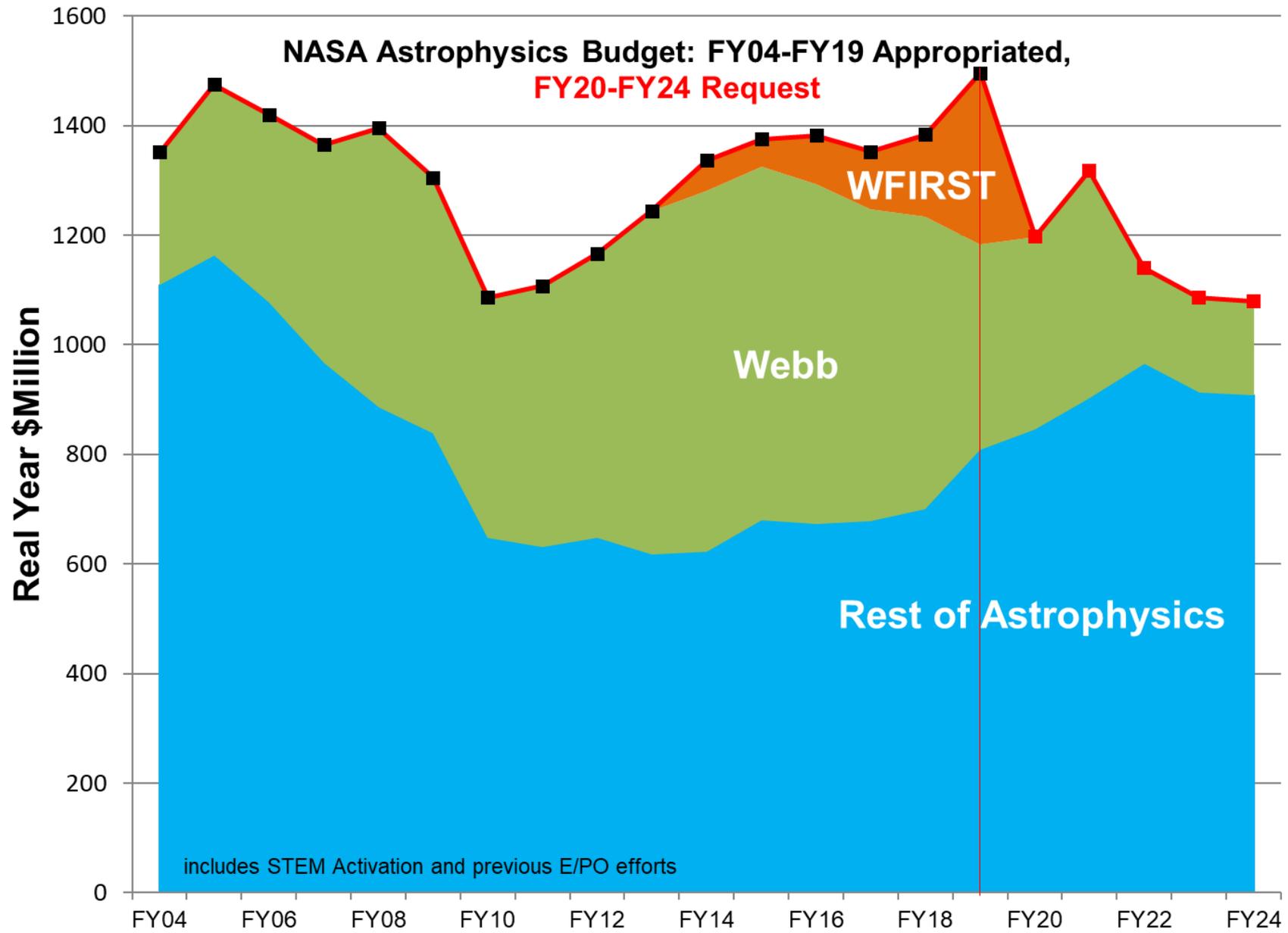
The FY20 President's Budget Request was released on March 11

The Budget requests a decreased level of funding for NASA Astrophysics

- Total funding requested for FY20 (Astrophysics including Webb) is ~1.197B, a decrease of \$187M (14%) from FY18 appropriation and a decrease of \$299M (20%) from FY19 appropriation.

The Budget also

- Accommodates Webb replan to March 2021 LRD
- Maintains decadal cadence of four AOs per decade for Astrophysics Explorers and Missions of Opportunity
- Extends SOFIA for three years beyond FY19; two alternate reviews are planned in 2019 in lieu of inclusion in 2019 Senior Review
- Supports mission concept studies and technology investments to implement Astrophysics Decadal Survey priorities starting in 2022
- Given its significant cost within proposed lower budget for Astrophysics and competing priorities within NASA, provides no funding for WFIRST space telescope while Webb is still being built





NASA Astrophysics Research and Analysis Update

Astrophysics Research and Analysis (R&A) Elements

ROSES-2019 released on March 14

Supporting Research and Technology

- Astrophysics Research & Analysis (APRA)
- Strategic Astrophysics Technology (SAT)
- Astrophysics Theory Program (ATP)
- Theoretical and Computational Astrophysics Networks (TCAN)
- Exoplanet Research Program (XRP)
- Roman Technology Fellowships (RTF)
- Astrophysics Science SmallSat Studies

Data Analysis

- Astrophysics Data Analysis (ADAP)
- GO/GI programs in ROSES for:
 - Fermi
 - Swift
 - NuSTAR
 - TESS
 - NICER

Mission Science and Instrumentation

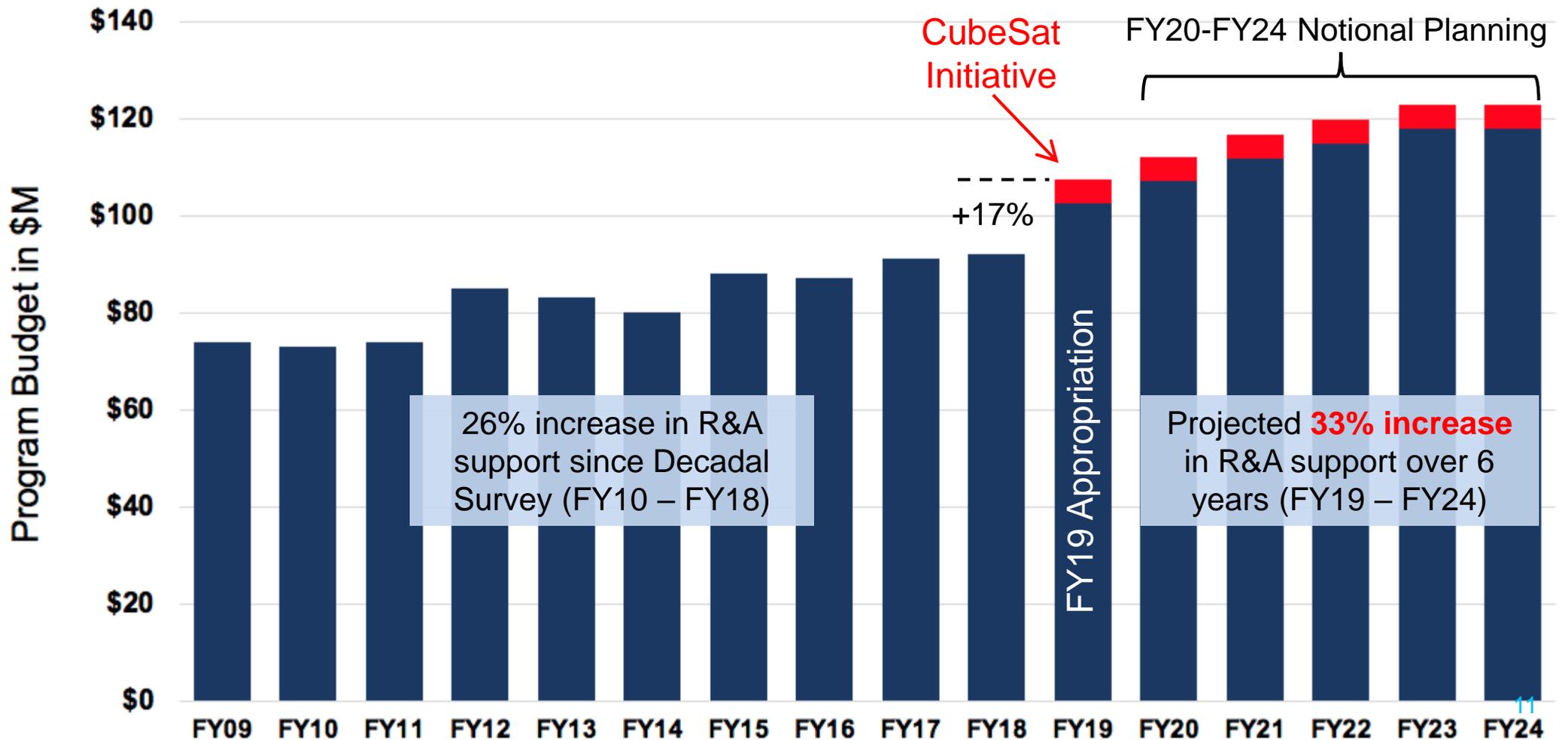
- Sounding rocket, balloon, cubesat, and ISS payloads solicited through APRA

Separately Solicited

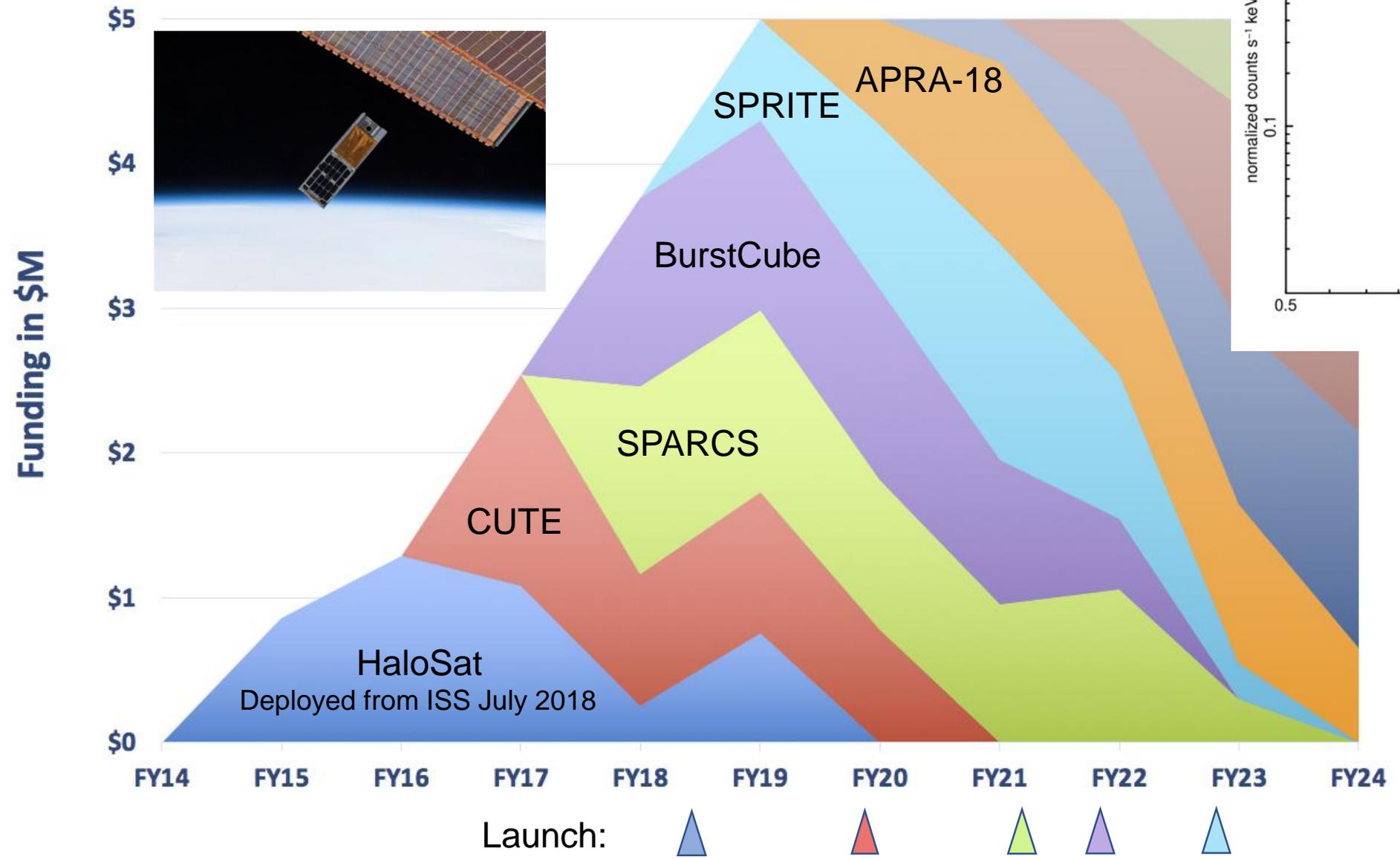
- GO/GI/Archive/Theory programs for:
 - Chandra
 - Hubble
 - SOFIA
 - Webb
- NASA Hubble Fellowship Program
- NASA Postdoctoral Program
- FINESST Graduate Student Research Awards (formerly known as NESSF)

Growth in R&A Funding (\$M)

Program	FY09	FY10	FY11	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23	FY24
R&A	\$74	\$73	\$74	\$85	\$83	\$80	\$88	\$87	\$91	\$92	\$103	\$107	\$112	\$115	\$118	\$118
CubeSat											\$5	\$5	\$5	\$5	\$5	\$5
Total	\$74	\$73	\$74	\$85	\$83	\$80	\$88	\$87	\$91	\$92	\$108	\$112	\$117	\$120	\$123	\$123



Astrophysics CubeSat Cadence





NASA Astrophysics HEAD-related Missions Update

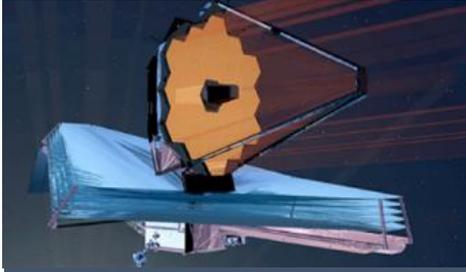
Astrophysics Missions in Development

TESS 4/2018
NASA Mission



Transiting Exoplanet Survey Satellite

Webb 2021
NASA Mission



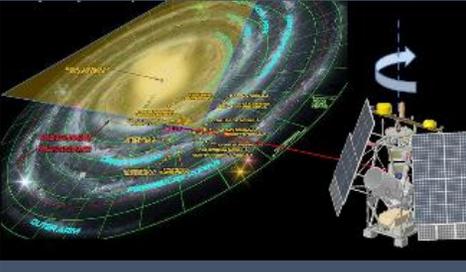
James Webb Space Telescope

IXPE 2021
NASA Mission



Imaging X-ray Polarimetry Explorer

GUSTO 2021
NASA Mission



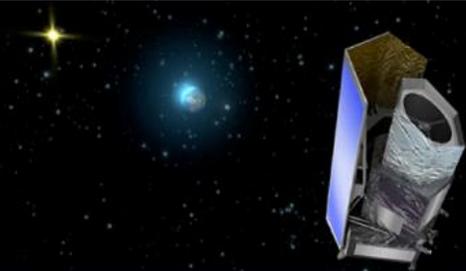
Galactic/ Extragalactic ULDB Spectroscopic Terahertz Observatory

XRISM 2022
JAXA-led Mission



NASA is supplying the SXS Detectors, ADRs, and SXTs

Euclid 2022
ESA-led Mission



NASA is supplying the NISP Sensor Chip System (SCS)

SPHEREx 2023
NASA Mission



Spectro-Photometer for the History of the Universe, Epoch of Reionization and Ices Explorer

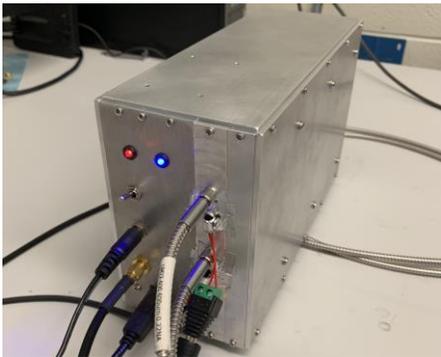
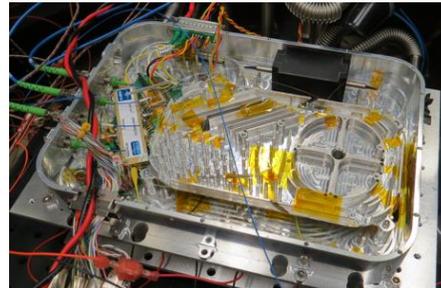
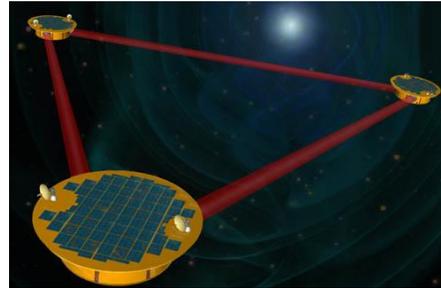
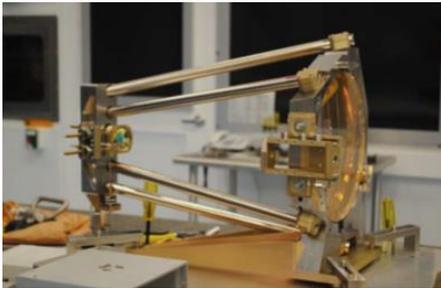
WFIRST Mid 2020s
NASA Mission



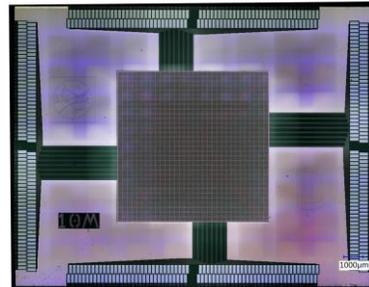
Wide-Field Infrared Survey Telescope

Laser Interferometer Space Antenna (LISA)

- ESA-led gravitational wave mission with NASA contributions; Launch date ~ 2030s
- NASA providing hardware to the payload. Currently funding 5 technologies as potential contributions:
 - Telescope (GSFC)
 - Laser (GSFC)
 - Microthrusters (JPL)
 - Phasemeter (JPL)
 - Charge Management System (Univ. Florida)
- NASA does not expect to provide all 5 technologies for flight due to budgetary and program constraints. These technologies will be downselected by NASA in partnership with ESA
- LISA Study Office (“proto-project”) at GSFC is responsible for managing technology investments and science contributions. US scientists deeply involved in Science Working Teams as part of the LISA Consortium



Advanced Telescope for High-Energy Astrophysics (Athena)



- NASA providing hardware (\$100M to \$150M), plus a U.S. GO program and a U.S. data center. Currently studying the following potential contributions:
 - X-ray Integral Field Unit (X-IFU) μ -calorimeter main sensor array (GSFC)
 - Wide Field Imager (WFI) ASIC design, heat pipes & radiators, Science Products Module (SPM) (Penn State, MIT, SAO, Stanford & GSFC)
 - Soft-Ride system (GSFC)
 - X-ray and Cryogenic Facility (XRCF) for possible calibration (MSFC)
- Athena Study Office (“proto-project”) at GSFC is responsible for managing technology investments and science contributions. US scientists Co-Is on instrument teams, represented on Athena Science Study Team, and Science Working Groups

Imaging X-ray Polarimetry Explorer (IXPE)

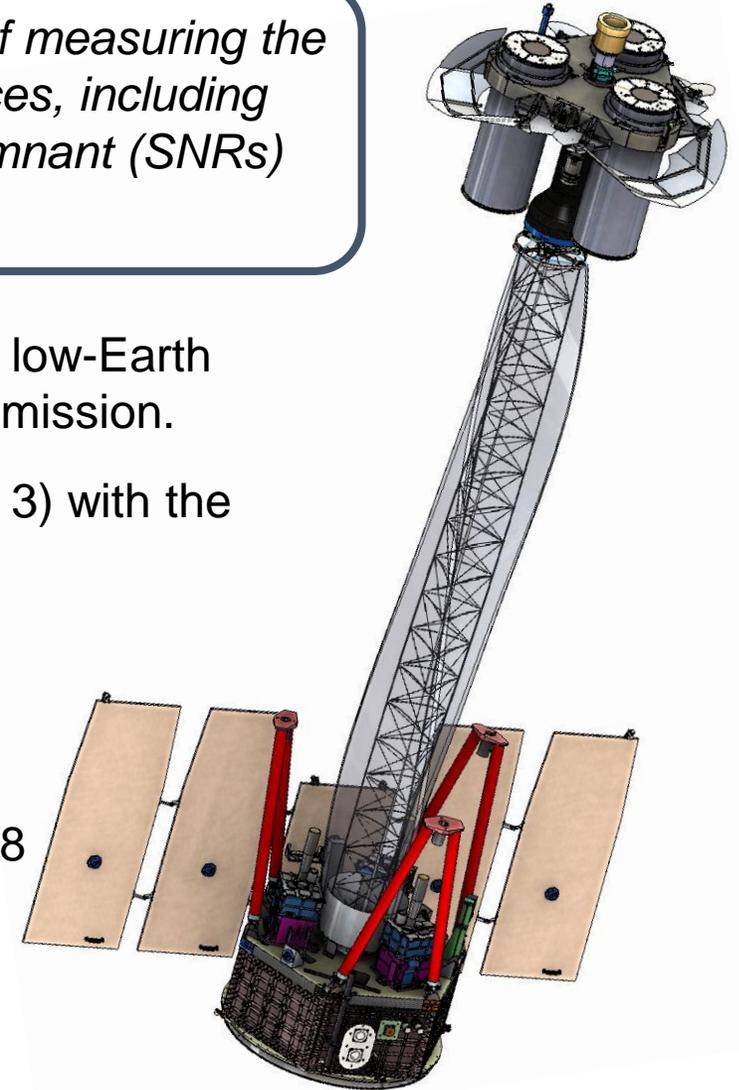
NASA's first imaging X-ray polarimetry mission capable of measuring the X-ray polarization of a significant number of cosmic sources, including neutron star binaries, black hole binaries, Supernova Remnant (SNRs) and Active Galactic Nuclei (AGN).

IXPE will be a 3-axis stabilized observatory launched into low-Earth equatorial orbit in April 2021 for a 2-year primary science mission.

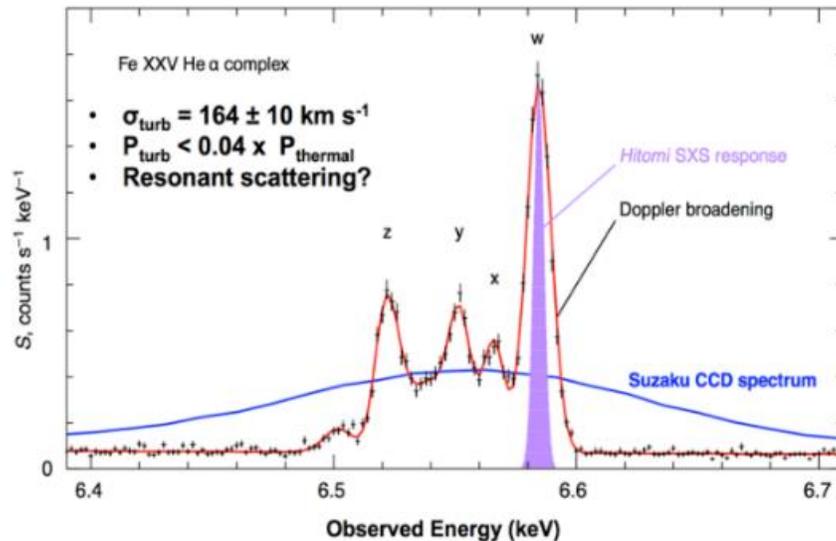
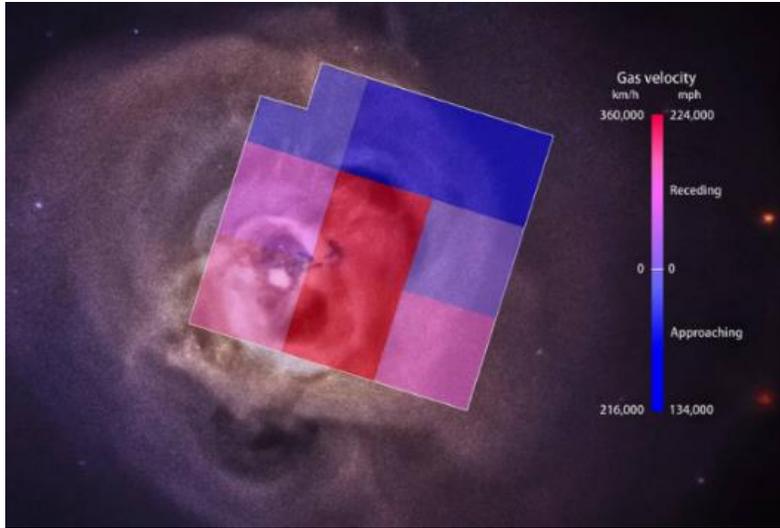
IXPE is a small Explorer-class mission (class D, category 3) with the PI/Project Office at MSFC.

Milestones

- ✓ Mission Preliminary Design Review (PDR): June 2018
- ✓ Mission Confirmation Review (KDP-C): November 2018
- Mission Critical Design Review (CDR): May 2019
- Launch: April 2021

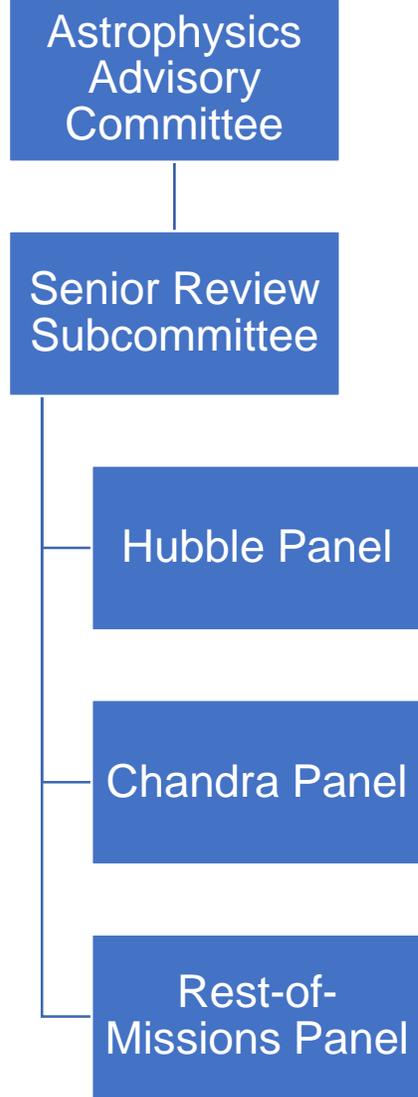
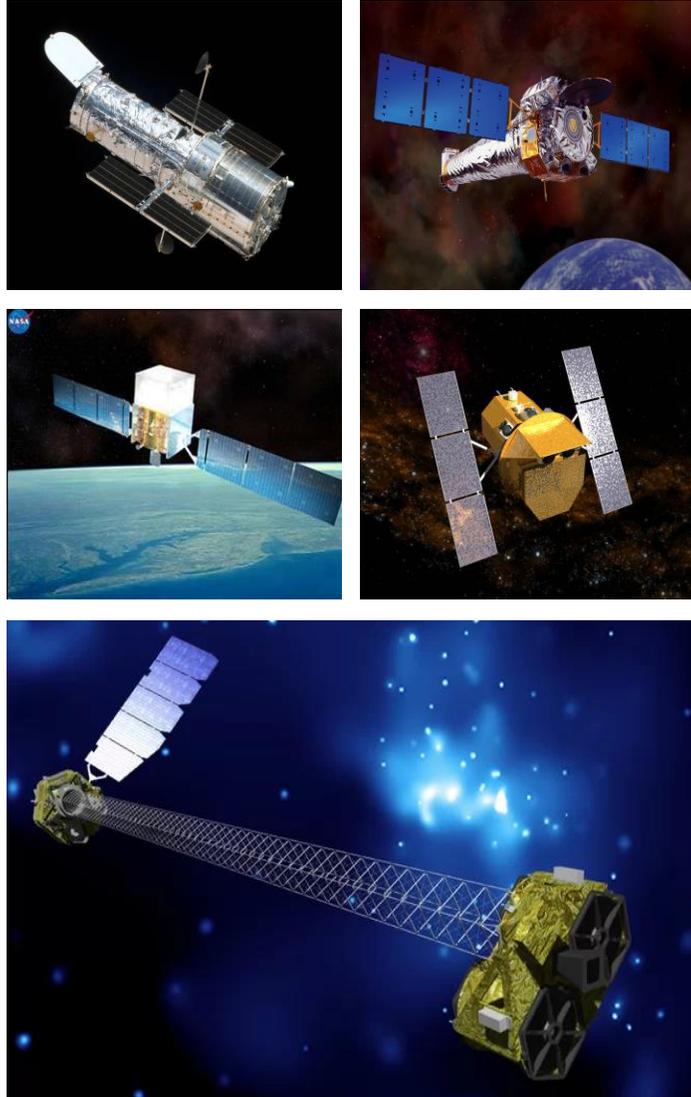


X-ray Imaging and Spectroscopy Mission (XRISM)



Launch readiness date: January 2022

- XRISM (formerly XARM) is the successor to ASTRO-H/Hitomi.
- Mission will include an X-ray microcalorimeter and an X-ray imager
- NASA will provide same hardware contribution as for Hitomi: X-ray microcalorimeter and X-ray mirrors
- XRISM project at NASA is now in Phase C, nearing the completion of the hardware build and preparing for test. The project is on plan for the pre-ship review on Oct 2019
- The JAXA XRISM project initiation was held on July 1, 2018 and the project is currently in Phase B. The mission PDR was held in early March.
- NASA project team engaged with JAXA at the instrument and mission level.
- U.S. Community Involvement
 - U.S. Participating Scientists on XRISM Science Team were selected in the Spring 2018. First XRISM science team meeting held in Nara, Japan, May 19-20, 2018. XRISM North American science team meeting held in Maryland, Sep 17-18, 2018
 - U.S. Scientists on Guaranteed Time Observing (GTO) Target Teams: to be selected approx. 1 year before launch
 - General Observing (GO) Program: Open to U.S. scientists starting 6-9 months after launch



Senior Review 2019

- Chandra X-ray Observatory (Chandra)
- Fermi Gamma-ray Space Telescope (Fermi)
- Hubble Space Telescope (Hubble)
- Neutron star Interior Composition Explorer (NICER)
- Nuclear Spectroscopic Telescope Array (NuSTAR)
- Neil Gehrels Swift Observatory (Swift)
- Transiting Exoplanet Survey Satellite (TESS)
- X-ray Multi-mirror Mission-Newton (XMM-Newton)

Results from Senior Review due mid-June.



Spitzer
8/25/2003

Kepler
3/7/2009
10/30/2018 EOM

■	Formulation
■	Implementation
■	Primary Ops
■	Extended Ops

WFIRST
Mid 2020s

Euclid (ESA)
2022

Webb
2021

Chandra
7/23/1999

XMM-Newton (ESA)
12/10/1999

TESS
4/18/2018

NuSTAR
6/13/2012

Fermi
6/11/2008

IXPE
2021

Swift
11/20/2004

XRISM (XARM) (JAXA)
2022

SPHEREx
2023

Hubble
4/24/1990

ISS-NICER
6/3/2017

ISS-CREAM
8/14/2017
2/15/2019 EOM

GUSTO
2021

SOFIA
Full Ops 5/2014

+ Athena (early 2030s), LISA (early 2030s)

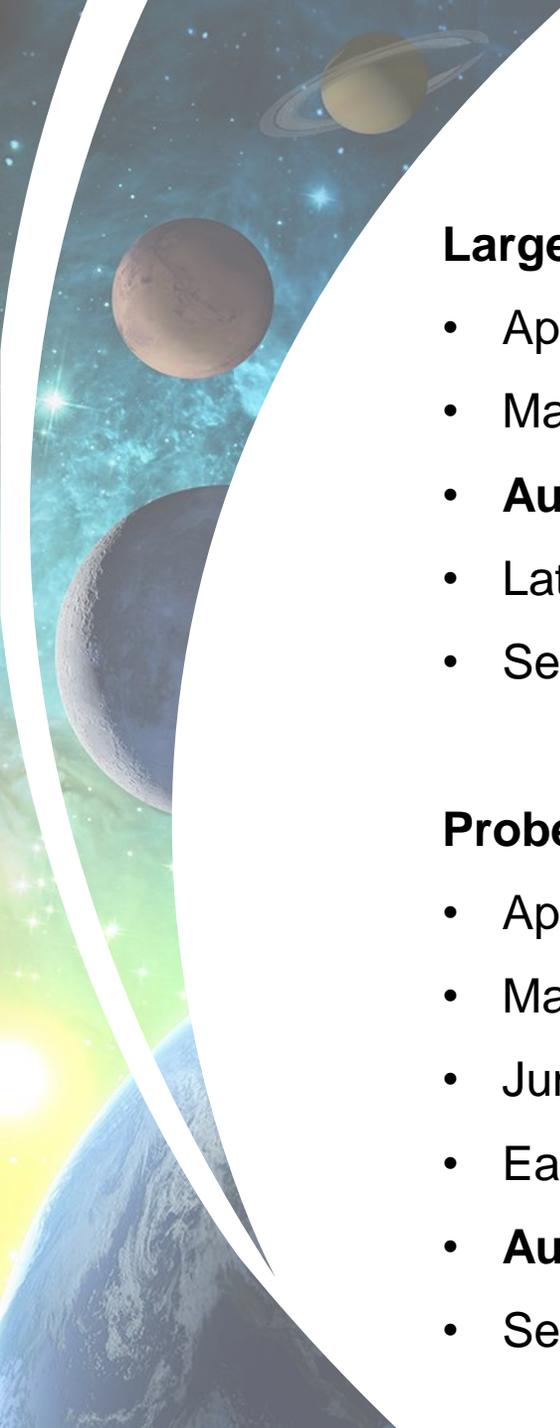


Costing the Large Mission Concepts

- NASA has assembled a Large Mission Concept Independent Assessment Team (LCIT) to conduct a technical, risk, and cost assessment of the four large-scale mission concept studies
 - The LCIT includes experienced technical and cost reviewers with expertise in large space missions and in science, instrumentation, and technology.
- The purpose of the LCIT is twofold:
 - Provide feedback to the STDTs that can be used to improve the Final STDT Reports that will be presented to the Decadal Survey
 - Provide NASA Headquarters confidence in the science, technical, cost, and risk conclusions of the Final STDT Reports that will be presented to the Decadal Survey
- The Terms of Reference for the LCIT are posted at <https://science.nasa.gov/astrophysics/2020-decadal-survey-planning>

Costing the Probe Mission Concepts

- NASA has requested GSFC and JPL's costing offices to perform independent cost assessments of the Probe mission concepts that used the resources of their respective Centers
- In order to provide an independent, non-advocate assessment of the costing offices' results, NASA is assembling an independent Probes Concept Assessment Team (PCAT)
 - The PCAT will validate the cost estimates provided by the costing offices, the design labs, and the PI-led studies
 - The PCAT is composed of scientists and subject matter experts who will work with the costing offices and the study teams
- The purpose of conducting a cost and technical validation of the Probe mission concept studies is to provide NASA Headquarters confidence in the science, technical, cost, and risk conclusions of the Probe Mission Concept Reports that will be presented to the Decadal Survey
- The Terms of Reference for the PCAT are posted at <https://science.nasa.gov/astrophysics/2020-decadal-survey-planning>



Timeline

Large Mission Concept Studies:

- April 26: the STDTs submit requested information to the LCIT to allow cost assessment
- May-July: the LCIT iterates multiple times with the STDTs
- **August 23: STDTs submit final report to HQ**
- Late August: LCIT submits written and oral report to HQ
- September: HQ submits studies package to Decadal

Probe Studies:

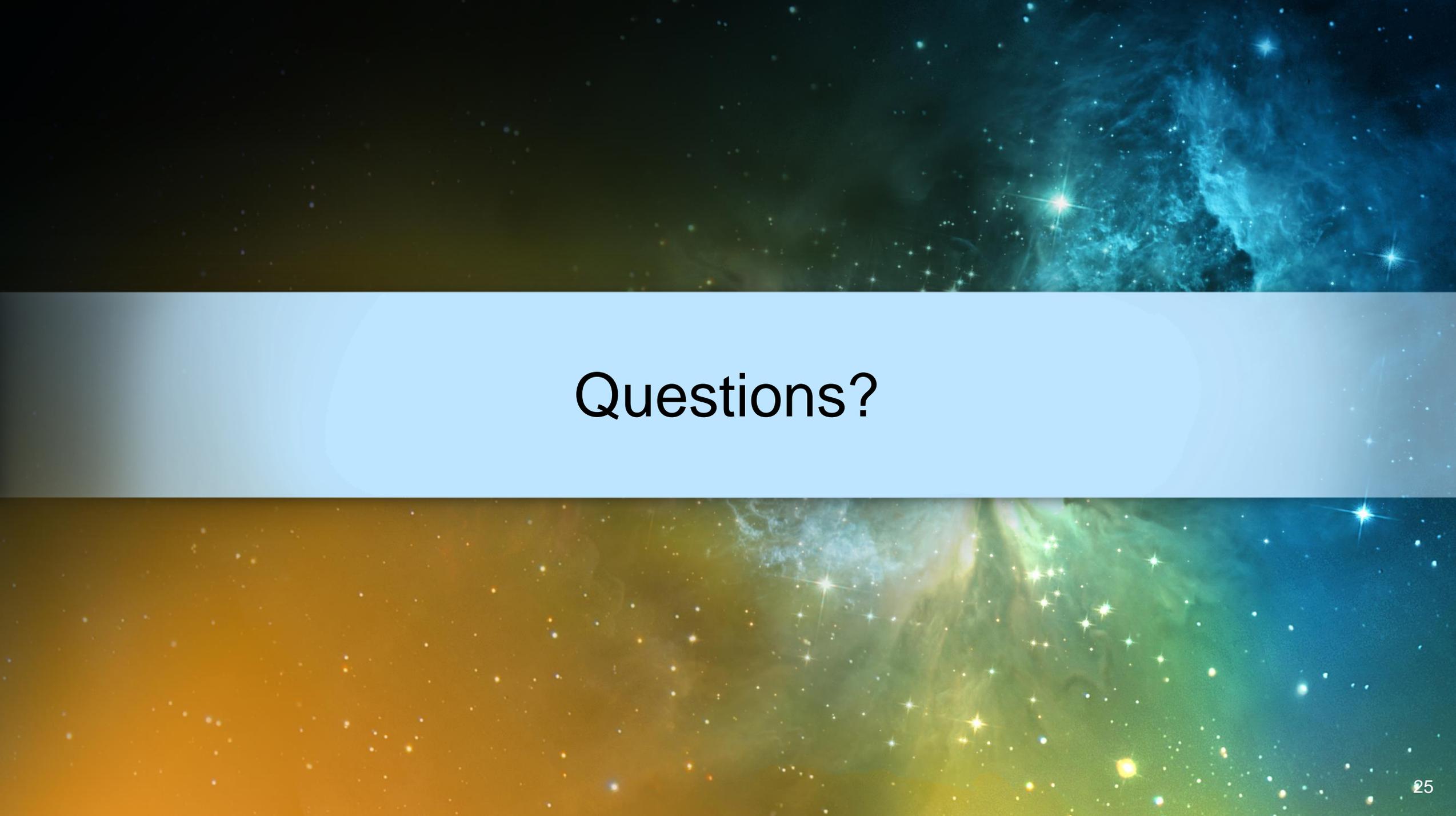
- April 4-5: PCAT-Teams Q&A session at GSFC
- May: Costing offices deliver their cost assessment
- June-August: PCAT review of the cost assessments
- Early August: PCAT debrief to Probes Teams
- **August: PCAT delivers written and oral report to HQ**
- September: HQ submits the studies package to the Decadal



Why Volunteer to Serve on a NASA Peer Review Panel?

- Personal professional development:
 - See how the whole review process works
 - Learn what constitutes excellent proposals
 - Network with your professional colleagues and NASA scientific staff
- Institutional achievement:
 - Improve at competing for NASA money
 - Increase knowledge of NASA's educational programs and research technology
- Investment in the future:
 - Help select the most transformative science
 - Ensure that all proposals receive a fair and competent review
- Sign up to be a panel reviewer:

<https://science.nasa.gov/researchers/volunteer-review-panels>

The background of the slide is a cosmic scene. The top half features a dark blue and black space filled with numerous small, bright stars and a prominent, glowing blue nebula on the right side. The bottom half transitions into a warmer color palette, with a golden-yellow and greenish glow, also containing many stars and a faint, glowing structure. A light blue horizontal band runs across the middle of the slide, containing the text.

Questions?